

REMARKS

By this amendment, and in conjunction with the RCE filed herewith, Applicants have amended claim 30. Claims 1, 5-29, 37, and 41-44 stand withdrawn. Claims 46, 49, 50, and 52 have now been canceled without prejudice. Claims 30, 35, 36, 38-40, and 51 are thus now presently under examination in the present application. Applicants submit that the present amendments place this application in condition for immediate allowance for at least the reasons set forth below.

As an initial matter, by virtue of this amendment, claim 30 has been amended to indicate that Segment A has a molecular weight of 5,000 to 1,000,000; to recite an ethylenic fluoromonomer containing sulfonic acid functional groups represented by Formula (1); and, to recite a Segment A : Segment B ratio of 30:70 to 90:10 wt.%. Support for these amendments can be found, for example, on page 23, line 3; page 14, lines 14 to 23; and, page 23, lines 17 to 21 of the specification of the present application. No new matter has been added by these amendments.

Claim Rejections – 35 U.S.C. §112

In the Office Action dated December 28, 2007, the Examiner rejected claim 30 and the claims depending from claim 30 under 35 U.S.C. §112, first paragraph. In making the rejection, the Examiner asserted that the specification does not

reasonably provide enablement for segment B of claim 30 to have a molecular weight in the range of 3,000 – 1,200,000.

Due to a typographical error, in the response to the previous Office Action that was filed October 12, 2007, the support for the molecular weight for segment B was incorrectly cited as being provided on page 28, lines 3-4 of the specification. The support for the molecular weight of Segment B, however, is described, for example, on page 23, lines 3-4 of the specification. Accordingly, Applicants respectfully traverse the Examiner's rejection and request that it be withdrawn.

Claim Rejections – 35 U.S.C. §103

In the present Office Action, the Examiner then rejected Claims 30, 35-36, 38-40, 46, and 49-52 under 35 U.S.C. §103(a) as being unpatentable over Cesar (US 6,492,431) or Cisar (5,635,039) (hereinafter “Cisar ‘431” and “Cisar ‘039”, respectively, and the “Cisar references,” collectively). In particular, the Examiner has alleged that the Cisar references describe not only a polymer blend, but also a block polymer comprised of segment blocks containing polytetrafluoroethylene (PTFE) and perfluorovinyl esters with sulfonic acid (PFSF) functional groups, commonly known as Nafion. Although, the Examiner admits that the Cisar references do not teach or suggest the molecular weights of Segment A and Segment B, the Examiner further alleges that it would have been obvious to one

skilled in the art at the time the invention was made to alter the amount of each material in order to provide a material having a desired size, strength, or ionic conductivity depending on the desired application. Moreover, the Examiner has also asserted that the polymer of the present invention also has the same modulus of elasticity of the Nafion described in the references.

The present invention, as defined by the claims as amended, is comprised of a block polymer that is formed using a specific ratio of Segments A and B having specific molecular weights. The present ratios and specific molecular weights result in a block polymer that has excellent mechanical properties and heat resistance even at high temperatures, as compared to a blend of polymers comprising the segments or a random block copolymer of the segments.

In contrast, the Cesar references merely describe a block copolymer in a similar manner as the polymer blend. The references teach or suggest nothing about the remarkable results that may be achieved by using a block copolymer in a specific ratio. For example, Cesar '431 merely discloses hypothetical blends of PTFE and PFSA in the Examples, and provides no specific examples of forming a block copolymer or the remarkable results that can be achieved with a block copolymer.

Furthermore, although the Examiner alleges that Cesar '431 discloses that the proportion of each type of segment can be selected within the range of 1 to 99

wt. %, one skilled in the art would not have easily arrived at the presently claimed ratio of Segment A : Segment B. Further, there is very little probability that one skilled in the art would realize the remarkable results that can be achieved by selecting the claimed ratio from such a broad proportion range, which covers substantially all ratios. It is thus clear that the Cisar references fail to teach or suggest using a block polymer at a specific ratio to achieve the superior results demonstrated by the material described and claimed in the present application.

Furthermore, as evidenced by the attached declaration of Tadashi Ino, the Applicants have measured the modulus of tension (dyn/cm²) of a block copolymer having a segment A : segment B ratio within the range recited in the claims of the present application, a block copolymer having a segment A : Segment B ratio outside of the range recited in the claims of the present application, and the commercial product Nafion. The attached declaration shows the comparison of the mechanical strengths of the films formed from the above polymers.

As is apparent from Fig. A of the attached Declaration, Block 1 (Equivalent Weight (EW)=879, segment A : segment B = 91.7 : 8.3 (wt.%)), in which the proportion of segment B containing no sulfonic acid fluoride group is outside the ratio defined in the claims (segment A : segment B = 30 : 70 to 90 : 10 (wt.%)) has a lower modulus of elasticity than the commercial product Nafion (EW 1100).

Block 2 (EW=946, segment A : segment B = 85.2 : 14.8 (wt.%)), in which the segment A : segment B ratio is within the ratio defined in the claims, has a higher modulus of elasticity than Block 1 and the commercial product Nafion (EW 1100) at high temperatures of 110°C or more, thus demonstrating greatly improved mechanical strength.

Further, since Block 2 (EW=946) has a lower molecular weight per sulfonic acid group (EW) (i.e., contains a smaller proportion of the structural reinforcing element PTFE than the commercial product Nafion (EW 1100)), it is usually presumed that Block 2 (EW=946) would have a lower mechanical strength than the commercial product Nafion (EW 1100). However, by forming a block copolymer with a specific segment A : segment B ratio of 30 : 70 to 90 : 10 (wt.%), a material for a solid polyelectrolyte can be obtained that has higher mechanical strength than the commercial product Nafion (EW 1100) containing a large proportion of the structural reinforcing element PTFE. This is clearly an unexpected result since the mechanical strength is thought to decrease as the proportion of the structural reinforcing element PTFE decreases.

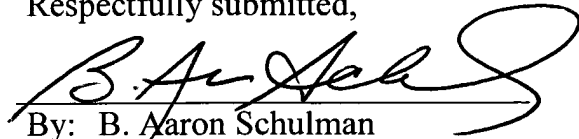
Moreover, Block 2 (EW=946) of the present invention also has excellent ion conductivity since it has a lower molecular weight per sulfonic acid group (EW) (i.e., contains a larger proportion of sulfonic acid groups as the ion conducting component in the polymer).

As discussed above, forming a block copolymer having a segment A : segment B ratio of 30 : 70 to 90 : 10 (wt.%) makes it possible to obtain a material for a solid polyelectrolyte that retains high ion conductivity and has higher mechanical strength than the commercial product Nafion (EW 1100), which contains a large proportion of the structural reinforcing element PTFE. Neither Cisar '431 nor Cisar '039 teaches or suggests the above-mentioned, specific ratio of segment A to Segment B and, thus one of ordinary skill in the art would not have known to form a block polymer with the above-mentioned Segment A : segment B ratio, much less one that could achieve the remarkable results exhibited by such a block polymer. Accordingly, the claims of the present application are clearly not rendered obvious by the cited Cisar references, and the Examiner's rejection on the basis of these references is respectfully traversed and should be withdrawn.

In light of the amendments and arguments provided herewith, Applicants submit that the present application overcomes all prior rejections and objections, and has been placed in condition for allowance. Such action is respectfully requested.

Respectfully submitted,

Date: April 28, 2008

A handwritten signature in black ink, appearing to read "B. Aaron Schulman", written over a horizontal line.

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